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WEED CONTROL IN NATIVE GRASSES FOR SEED OR FORAGE

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Weed Control in Native Grasses for Seed or Forage Production

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Final Report of
The Melfort Research Station

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1. Executive Summary

1.1. Abstract

The objective of this study is to determine tolerance of several native grasses to various herbicides when grown for forage or seed production.

Cool season grasses (Northern wheatgrass, Western wheatgrass, Slender wheatgrass and Canada wild ryegrass) were established at Portage la Prairie, MB and Melfort, SK. Visual rating were done at approximately 14 and 28 days after application.

Cool season grasses herbicide application consisted of Prestige, Curtail M, Prevail and Refine Extra. All herbicides were applied at the recommended rate and also two times the recommended rate.

Warm season grasses (Big blue stem, Little blue stem, Prairie sandreed and Blue grama) were sown at Portage la Prairie, MB. An Achieve DG on green needle grass trial was also seeded at Portage la Prairie as well as at Melfort. There were establishment issues and the warm season sites were abandoned. Another warm season site was established in Swift Current, Sk by AAFC staff. Visual ratings were done at approximately 14 and 28 days after application on these trials as well.

Warm season grasses herbicide application consisted of Attain, Curtail M, Oddyssey, Pursuit, Prestige, Refine Extra and Triumph Plus.

1.2. Impact on Saskatchewan Agriculture

Interest in native grass seed production has been growing over the past decade throughout North America. A considerable market for cool-season native grass seed has developed over the past years in the Northern great plains of the U.S. due to the renew of the Conservation Reserve Program. Many of the varieties grown in Canada and Saskatchewan originated in the U.S. and are ecologically adapted to the Northern Great Plains states and provide an additional export market opportunity for Canadian forage seed producers. Seed sources for varieties and ecovars of native grass species are available or will be available to the market within the next year. Sources of breeder and foundation seed will enable seed companies to expand contracted production, complete and upgrade processing facilities and service domestic and international markets. An increasing number of individual growers already have increased production of native species and have had good success marketing their product. Therefore, it is imperative that all growers be encouraged to produce pedigreed seed that meets both Canadian and international purity requirements. The information collected by this project will enable forage seed producers to produce pedigreed seed that meets with Saskatchewan and international purity requirements.

1.3. Technology Transfer

Previous ADF reports have been handed out to various farm managers and extension personnel. ADF reports and other forage information are made available at various trade shows and seminars. The data base from this study will be submitted to ECW and be used for minor use registration of the tested herbicides by Saskatchewan forage seed producers.

1.4. Extension Activities Completed

The researchers and staff pass along all information at field days and extension meetings wherever possible.

1.5. Personnel

Work for this project was contracted out to ICMS (Portage la Prairie, MB) or performed by employees of the Agriculture and Agri-Food Canada Research Stations at Melfort (Melfort, Sask) and SPARC (Swift Current).

1.6. Equipment

No items valued at more than $500 were purchased with project funds.

1.7. Deviation from Original Work Plan

Refer to appendices A and B.

1.8. Achievements

Cool season grasses (Northern wheatgrass, Western wheatgrass, Slender wheatgrass and Canada wild ryegrass) as well as an Achieve DG on Green needle grass trial were established at Portage la Prairie, MB and Melfort, SK. Warm season grasses (Big blue stem, Little blue stem, Prairie sandreed and Blue grama) were established at Portage la Prairie, MB. The Canada Wild ryegrass seed that was provided by Ducks Unlimited and seeded at Melfort was contaminated with other seed and as such only visual ratings were done on this species. The test seeded in 2000 was seeded with pure seed. The cool season trial at Melfort was sprayed with herbicides on July 12, 2000. The (Western Wheatgrass) stayed vegetative and did not produce seed heads in 2000. The cool season trial at Portage la Prairie was also sprayed with herbicides in 2000.

Herbicide application consisted of Prestige, Curtail M, Prevail and Refine Extra. All herbicides were applied at the recommended rates and also two times the recommended rate. Visual ratings at Portage la Prairie for the cool season grasses showed variable tolerance to the herbicide treatments, however the tolerances appeared to be within acceptable limits. The visual ratings data from Melfort on cool season grasses also showed variable but acceptable tolerance at 14DAT. At 28DAT all of these grasses recovered to the point where there was no visible sign of injury from the herbicide application.

Warm season grasses (Big blue stem, Little blue stem, Prairie sandreed and Blue grama) were sown at Portage la Prairie, MB. Because the warm season grasses failed to establish well enough over the summer to allow herbicide application in 1999, two warm season trials were established at Portage la Prairie in the spring of 2000 in order to compensate for the lost trial in 1999. However, again difficulty in establishment was encountered due to pest pressures (gophers) and limited data were collected.

A new warm season grass trial was seeded at Swift Current in the fall of 2001. Due to the ongoing drought conditions that prevailed at the time, it was decided to try to establish this trial using the dormant seeding method. An extreme variance in establishment was seen across the species being tested. Again, significant pest pressures coupled with drought conditions, prevented successful establishment of all species. Big bluestem and green needlegrass were the only 2 species that had enough of a stand to retrieve any data. In the summer of 2002, the herbicide treatments were applied. 14dat and 28dat visual assessments were done as well as forage yield cuts. Seed was harvested from the green needlegrass plots in the summer of 2003. All visual injury ratings were found to be well within acceptable levels. There were no significant differences in the forage yields compared to the UTC. Seed yields of the treated plots also showed no significant difference from the UTC, as would be expected due to the extremely low seed yields harvested.

The Achieve DG on green needle grass trial that was seeded at Portage la Prairie in 2000 exhibited variable but acceptable tolerance to treatment applications at 16DAT. By 30DAT there were no differences in crop tolerance between the treatments and the UTC.

The Achieve DG on Green needle grass seeded at Melfort in 1999 was abandoned in 2000 due to severe pest pressures. A new trial was seeded in 2000 at a different site. Crop tolerance data that were taken from both trials indicated that green needle grass was tolerant to Achieve DG at the 1X and 2X rates from the 1 to 6 leaf stage.

All of the grass species tested were tolerant to the herbicides applied to them with the exception of the product Sundance. Refer to Appendix D for results of the data and tables.

Green needlegrass

There has been some question as to the tolerance of green needlegrass to Tralkoxydim (Achieve DG) at different plant stages. A trial was established to investigate the tolerance of green needlegrass to this product at the 1 to 3 leaf stage and at the 4 to 6 leaf stage. The product was applied at the 1 X rate as well as the 2 X rate at each stage in an RCBD format using 4 replicates. In 1999 the trial was abandoned due to extreme pest pressures. In 2000, at the 1-3 leaf stage, Achieve DG was applied at the 10X and 20X rates and due to an improper calculation factor in the PRM program. The factor was corrected prior to the application of treatments at the 4-6 leaf stage and treatments were applied at the 1X and the 2X rates.

Results: There were significant differences in the amount of visual injury sustained from treatment application. However, tolerance to Achieve DG was within the acceptable range (< 20%) at both rates and both stages of application. Table 1.

Table 1. Visual injury ratings from application of Achieve DG to seedling green needlegrass near Melfort in 1999.

Treatment	% injury 14dat[1]	% injury 28dat
Check 1-3 leaf stage	0c	0c
Achieve 1X 1-3 leaf stage	5b	3b
Achieve 2X 1-3 leaf stage	9a	5a
Check 4-6 leaf stage	0c	0c
Achieve 1X 4-6 leaf stage	6ab	3b
Achieve 2X 4-6 leaf stage	9a	6a
stats:		
mean	5	3
CV	41	38
LSD alpha= .05	3	2
Pr>F	.0001	.0001

In 2000, another trial was established to investigate the tolerance of green needlegrass to a variety of broadleaf herbicides applied in the seedling year. This trial was set up as an RCBD using 4 replicates

Results: There were significant differences from the untreated check in the amount of injury sustained from treatment application of Sundance at both the 1X and 2X levels in visual assessments as well as seed yield. Tolerance to all other herbicides in this trial showed no signs of injury neither visually nor in a significant reduction in seed yield.

Table 2. Green Needlegrass tolerance to a variety of herbicides applied in the seedling year of 2000. Melfort, Sask.

treatment	% injury 14dat	% injury 28 dat	2001 seed yield kg/ha	TKWT
Check	0	0	435	2
Refine Extra 1X	0	0	515	2
Refine Extra 2X	0	0	459	2
Prevail 1X	0	0	526	1.9
Prevail 2X	0	0	465	2
Curtail M 1X	0	0	431	2
Curtail M 2X	0	0	499	1.9
Prestige 1X	0	0	494	2
Prestige 2X	0	0	461	2
Sundance 1X	74	93	46	2.3
Sundance 2X	76	97	23	2.4
Stats:				
mean	13.6	17.3	396	2
C.V.	11.9	7.5	34	6.8
LSD alpha =.05	2.3	1.9	194	0.2
Pr>F	<.0001	<.0001	<.0001	.0002

Northern Wheatgrass

Two trials were established, one looking at the tolerance of this grass to a variety of broadleaf herbicides and another looking at the tolerance of this grass to Avadex BW applied after the crop was established with 1 of 2 application dates. This grass was seeded in 6 foot wide strips with the treatments applied perpendicular to the direction of seeding.

Table 3. Northern Wheatgrass tolerance to a variety of herbicides applied in the seeding year of 1999 and 2000 at Melfort.

	1999					2000				
treatment	% injury 14dat	% injury 28 dat	2000 seed yield kg/ha	TKW T	% germ	% injury 14dat	% injury 28 dat	2001 seed yield kg/ha	TKW T	% germ
check	0	0	254	n/a	n/a	0	0	124	2.57	80.3
Refine Extra 1X	11	0	353	n/a	n/a	0	0	154	2.72	83.0
Refine Extra 2X	3	0	302	n/a	n/a	0	0	178	2.67	82.5
Curtail M 1X	4	0	312	n/a	n/a	0	0	144	2.59	81.8
Curtail M 2X	8	0	271	n/a	n/a	0	0	203	2.74	75.0
Prestige 1X	5	0	339	n/a	n/a	0	0	181	2.69	85.3
Prestige 2X	6	0	314	n/a	n/a	0	0	184	2.64	80.0
Prevail 1X	5	0	355	n/a	n/a	0	0	220	2.67	81.5
Prevail 2X	5	0	266	n/a	n/a	0	0	231	2.58	77.3
stats										
mean	5.3	0	308	n/a	n/a	0	0	180	2.65	80.7
C.V.	90	.	29	n/a	n/a	.	.	31.0	5.2	10.2
LSD alpha =.05	ns	ns	ns	n/a	n/a	ns	ns	81.3	.20	12.0
Pr>F	.1577	.	.6692	n/a	n/a	.	.	.1800	.6353	.8001

Table 4. Northern Wheatgrass visual injury ratings and seed yield resulting from the application of Avadex BW on Northern Wheatgrass at 2 rates and 2 timings of application, fall 2000 and spring 2001. Melfort, Sask.

Treatment	injury 14dat	injury 28dat	spring injury	2001 seed yield kg/ha
spring check	0	0	.	77
spring Avadex BW 1X	0	0	.	54
Spring Avadex BW 2X	0	0	.	59
fall check	.	.	0	52
fall Avadex BW 1X	.	.	0	65
fall Avadex BW 2X	.	.	0	71
stats:				
mean	0	0	0	62.8
c.v.	.	.	.	38
LSD @ alpha=.05	.	.	.	36

Western Wheatgrass

Two trials were established, one looking at the tolerance of this grass to a variety of broadleaf herbicides and another looking at the tolerance of this grass to Avadex BW applied after the crop was established at 1 of 2 application dates. This grass was seeded in 6 foot wide strips with the treatments applied perpendicular to the direction of seeding.

Table 5. Western Wheatgrass tolerance to a variety of herbicides applied in the seeding year of 1999 and 2000 at Melfort.

	1999					2000				
treatment	% injury 14dat	% injury 28 dat	2000 seed yield kg/ha *	TKW T	% germ	% injury 14dat	% injury 28 dat	2001 seed yield kg/ha	TKW T	% germ **
check	0	0	n/a	n/a	n/a	0	0	77	3.11	n/a
Refine Extra 1X	11.3	0	n/a	n/a	n/a	0	0	93	3.21	n/a
Refine Extra 2X	2.5	0	n/a	n/a	n/a	0	0	124	3.12	n/a
Curtail M 1X	5	0	n/a	n/a	n/a	0	0	75	3.15	n/a

Curtail M 2X	7.5	0	n/a	n/a	n/a	0	0	150	3.30	n/a
Prestige 1X	3.8	0	n/a	n/a	n/a	0	0	130	3.15	n/a
Prestige 2X	6.3	0	n/a	n/a	n/a	0	0	102	3.23	n/a
Prevail 1X	6.3	0	n/a	n/a	n/a	0	0	131	3.34	n/a
Prevail 2X	6.3	0	n/a	n/a	n/a	0	0	142	3.16	n/a
stats										
mean	5.4	.	n/a	n/a	n/a	0	0	113.8	3.2	n/a
C.V.	78	.	n/a	n/a	n/a	.	.	37.6	5.8	n/a
LSD alpha =.05	6.1	0	n/a	n/a	n/a	ns	ns	62.4	.27	n/a
Pr>F	.0553	.	n/a	n/a	n/a	.	.	.1537	.6466	n/a

* note - plants remained vegetative in 2000 , as such there was no seed production.
**note - the western wheatgrass seed that was harvested exhibited a significant amount of dormancy. Germination in the test was almost non-existent. Tetrazolium testing will have to be done for potential germination analysis.

Table 6. Western Wheatgrass visual injury ratings and seed yield resulting from the application of Avadex BW on Western Wheatgrass at 2 rates and 2 timings of application, fall 2000 and spring 2001.
Melfort, Sask.

treatment	injury 14dat	injury 28dat	spring injury	seed yield kg/ha
spring check	0	0	.	49
spring Avadex BW 1X	0	0	.	61
Spring Avadex BW 2X	0	0	.	31
fall check	.	.	0	49
fall Avadex BW 1X	.	.	0	32
fall Avadex BW 2X	.	.	0	43
stats:				
mean	0	0	0	44
c.v.	.	.	.	25
LSD @ alpha=.05	0	0	0	16.4
Pr>F	.	.	.	.0105

Slender Wheatgrass

Two trials were established, one looking at the tolerance of this grass to a variety of broadleaf herbicides and another looking at the tolerance of this grass to Avadex BW applied after the crop was established at 1 of 2 application dates. This grass was seeded in 6 foot wide strips with the treatments applied perpendicular to the direction of seeding.

Table 7. Slender Wheatgrass tolerance to a variety of herbicides applied in the seeding year of 1999 and 2000 at Melfort.

	1999					2000				
treatment	% injury 14dat	% injury 28 dat	2000 seed yield kg/ha	TKW T	% germ	% injury 14dat	% injury 28 dat	2001 seed yield kg/ha	TKW T	% germ
check	0	0	962	n/a	n/a	0	0	550	3.11	58
Refine Extra 1X	4	0	982	n/a	n/a	0	0	526	3.07	60.5
Refine Extra 2X	4	0	1147	n/a	n/a	0	0	545	3.10	60.8
Curtail M 1X	3	0	1079	n/a	n/a	0	0	528	3.16	58.5
Curtail M 2X	2	0	990	n/a	n/a	0	0	509	3.06	66.8
Prestige 1X	3	0	924	n/a	n/a	0	0	545	3.10	63.3
Prestige 2X	4	0	1204	n/a	n/a	0	0	496	3.02	66.3
Prevail 1X	6	0	1077	n/a	n/a	0	0	532	3.08	68
Prevail 2X	5	0	1009	n/a	n/a	0	0	591	3.15	66.5
stats										
mean	3.5	0	1041	n/a	n/a	0	0	536	3.09	63.2
C.V.	90.7	.	17.1	n/a	n/a	.	.	16.5	3.3	12.1
LSD alpha =.05	ns	ns	ns	n/a	n/a	ns	ns	129	.15	11.1
Pr>F	.2419	.	.4233	n/a	n/a	.	.	.9212	.5919	.4483

Table 8. Slender Wheatgrass visual injury ratings and seed yield resulting from the application of Avadex BW on Slender Wheatgrass at 2 rates and 2 timings of application, fall 2000 and spring 2001.
Melfort, Sask.

Treatment	injury 14dat	injury 28dat	spring injury	seed yield kg/ha
spring check	0	0	.	354
spring Avadex BW 1X	0	0	.	366
Spring Avadex BW 2X	0	0	.	320
fall check	.	.	0	312
fall Avadex BW 1X	.	.	0	371
fall Avadex BW 2X	.	.	0	337
stats:				
mean	0	0	0	343
c.v.	.	.	.	19.5
LSD @ alpha=.05	0	0	0	100.9
Pr>F	.	.	.	.7476

Canada Wildrye

Two trials were established, one looking at the tolerance of this grass to a variety of broadleaf herbicides and another looking at the tolerance of this grass to Avadex BW applied after the crop was established at 1 of 2 application dates. This grass was seeded in 6 foot wide strips with the treatments applied perpendicular to the direction of seeding.

Table 9. Canada Wildrye tolerance to a variety of herbicides applied in the seeding year of 1999 and 2000 at Melfort.

	1999 contaminated seed lot					2000				
treatment	% injury 14dat	% injury 28 dat	2000 seed yield kg/ha	TKW T	% germ	% injury 14dat	% injury 28 dat	2001 seed yield kg/ha	TKW T	% germ **
check	n/a	n/a	n/a	n/a	n/a	0	0	889	3.73	n/a
Refine Extra 1X	n/a	n/a	n/a	n/a	n/a	0	0	736	3.67	n/a
Refine Extra 2X	n/a	n/a	n/a	n/a	n/a	0	0	692	3.78	n/a
Curtail M 1X	n/a	n/a	n/a	n/a	n/a	0	0	795	3.92	n/a
Curtail M 2X	n/a	n/a	n/a	n/a	n/a	0	0	695	3.68	n/a
Prestige 1X	n/a	n/a	n/a	n/a	n/a	0	0	703	3.63	n/a
Prestige 2X	n/a	n/a	n/a	n/a	n/a	0	0	815	3.67	n/a
Prevail 1X	n/a	n/a	n/a	n/a	n/a	0	0	777	3.64	n/a
Prevail 2X	n/a	n/a	n/a	n/a	n/a	0	0	810	3.81	n/a
stats										
mean	n/a	n/a	n/a	n/a	n/a	0	0	768	3.72	n/a
C.V.	n/a	n/a	n/a	n/a	n/a	.	.	20.6	4.6	n/a
LSD alpha =.05	n/a	n/a	n/a	n/a	n/a	ns	ns	230.5	.25	n/a
Pr>F	n/a	n/a	n/a	n/a	n/a	.	.	.6742	.3268	n/a

Table 10. Canada Wildrye visual injury ratings and seed yield resulting from the application of Avadex BW on Canada Wildrye at 2 rates and 2 timings of application, fall 2000 and spring 2001. Melfort, Sask.

Treatment	injury 14dat	injury 28dat	spring injury	seed yield kg/ha
spring check	0	0	.	517
spring Avadex BW 1X	0	0	.	574
Spring Avadex BW 2X	0	0	.	521
fall check	.	.	0	575
fall Avadex BW 1X	.	.	0	603
fall Avadex BW 2X	.	.	0	576
stats:				
mean	0	0	0	561
c.v.	.	.	.	21.8
LSD @ alpha=.05	0	0	0	184
Pr>F	.	.	.	.8953

Results for these 5 species are as follows:

Although crop injury varied at the 14dat rating, all signs of injury were well within acceptable levels. Visual injury ratings showed complete recovery at the 28dat rating. Seed yield, germination and thousand kernel weights showed no significant differences when data from the treated plots was compared to the untreated check

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Table 11. Big Bluestem herbicide tolerance trial at Swift Current dormant seeded in the fall of 2001 with herbicides applied in the summer of 2002. Injury ratings done in 2002 and yields done in 2003.

Treatment	injury 14dat	injury 28dat	forage yield kg/ha
Check	5	0	546
Attain 1X	6.3	10	1240
Attain 2X	3.8	0	1029
Curtail M 1X	0	0	781
Curtail M 2X	2.5	0	1110
Odyssey 1X	2.5	0	1136
Pursuit 1X	5	0	863
Prestige 1X	0	0	715
Prestige 2X	5	10	425
Refine Extra 1X	2.5	0	727
Refine Extra 2X	5	0	733
Triumph Plus 1X	0	0	1008
Triumph Plus 2X	3.8	0	907
stats:			
Mean	3.17	1.5	863
cv	161	.	96
LSD@alpha=.05	7.3	.	1189
Pr>F	.7418	.	.9777

Table 12. Green Needlegrass herbicide tolerance trial at Swift Current dormant seeded in the fall of 2001 with herbicides applied in the summer of 2002. Injury ratings done in 2002 and yields done in 2003.

Treatment	injury 14dat	injury 28dat	forage yield kg/ha	seed yield kg/ha
Check	5.5	5	2195	12.5
Attain 1X	2.5	10	1494	12.5
Attain 2X	2.5	0	1546	15.5
Curtail M 1X	0	0	2123	8.7
Curtail M 2X	0	0	1531	10.1
Odyssey 1X	0	0	1402	17.6
Pursuit 1X	0	0	1823	18.7
Prestige 1X	2.5	0	1271	10.8
Prestige 2X	7.5	10	2030	13.9
Refine Extra 1X	2.5	0	1011	14.9
Refine Extra 2X	0	0	1143	10.9
Triumph Plus 1X	6.3	5	1542	11.9
Triumph Plus 2X	2.5	0	1080	8.2
stats:				
Mean	2.3	2.3	1553	12.78
cv	165	125	67	80.8
LSD@alpha=.05	5.5	6.3	1484	14.8
Pr>F	.1236	.0173	.8516	.958